

The Linkage between Ecological Knowledge and Behaviour Intention in Green Campus Students

Riyadi, I. P.¹, Prayitno, B. A.², Karyanto P.³

¹Magister Science Education, Sebelas Maret University, Surakarta.

²Faculty Of Teacher Training And Education, Sebelas Maret University, Surakarta.

³ Research Group Of Human And Environmental Interface, Environmental Studies Of Sebelas Maret University, Surakarta

Corresponding email: idhunriyadi@gmail.com

ABSTRACT

The UI GreenMetric is a university world ranking for universities to assess and compare campus sustainability efforts. UI GreenMetric's ultimate goal is to assess how committed the universities are to environmental management in the campus area. Sebelas Maret University is ranked 76th in the world and 5th in the national level. Measurement of the ecological literacy ability of the students of Sebelas Maret University received low results on attitude and knowledge aspects. Measurement of attitude aspect using NEP scale got an average result equal to 62% while measurement of knowledge aspect using a scale of ecology concept gets an average result equal to 56%. This paper intends to discuss the relationship between attitude and knowledge aspects of students at Sebelas Maret University. Quantitative regression analysis is used to look at the relationship between the two aspects of ecological literacy on lecture activities and student attitude observation. Improved environmental management in the campus area can be done by improving the concept of students first because it can affect how students behave.

Keywords: UI GreenMetric; ecological literacy; NEP; regression

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INTRODUCTION

UI GreenMetric is a world ranking to measure the university's ability in maintaining sustainable environments (Team, 2016). The sustainable university is defined as institutions of higher education that address, engage and promote at the regional and global levels in addressing environmental, economic, social and health issues in the use of resources to meet the needs by helping communities to achieve sustainable lifestyles (Hordijk, 2014). One of the goals set by UI GreenMetric is to see contributions on the academic discourse about sustainability in education and campus greening programs. Universities that can participate in the UI GreenMetric are those with a strong commitment to protecting campus environment on sustainability issues. Participating universities can help to raise awareness among campus residents as well as its surroundings on the importance of sustainability issues. UI GreenMetric has realized the importance of education's role to raise awareness for sustainable development (Team, 2016). There are 407 universities worldwide who have participated in UI GreenMetric and 28 of them are from Indonesia.

Those 28 universities in Indonesia participating in UI GreenMetric have maintained a sustainable campus environment through the Green Campus Action. Green Campus is a place to implement eco-friendly practices by combining the role of education to promote the campus sustainability program (NEEATeam). Green Campus program is expected to arise from the awareness and concern of campus residents to preserve the environment. Campus residents can examine environmental issues and provide solutions through the Green Campus Action (UNS, 2014). Sebelas Maret University (UNS) is on 76th rank at world level with a value of 5960 (Rizki, 2016). UNS with 6 other universities was selected as Pilot Project to implement Green Campus under the guidance of the Environment Ministry (UNS, 2014). The Green Campus program must be started from the internal colleges by involving all academicians such as student activities units, lecturers, employees, and campus structural officials to create an eco-friendly campus. Educational programs provided must be in accordance with the purpose of Green Campus which is environment-based education. Well-managing Environmental-based education can be beneficial to improve eco-friendly behavior (Cheang, Winnie So, Zhan, & Tsoi, 2017; Li & Lang, 2015).

The implementation of the Green Campus program is influenced by the awareness and concern of campus residents, especially by students. Students must demonstrate eco-friendly behavior in implementing the Green Campus program. Eco-friendly behavior has been regarded as one of the promising concepts to address environmental concerns (Newhouse, 1990). Student behavior is influenced by readiness to behave. It is to show how one's cognitive readiness to behave (Ajzen I., 2001). So it can be said that a person's behavior is influenced by their level of cognitive. A person's cognitive level is one of three components to measure eco-friendly behavior (Kaiser, Wolfing, & Fuhrer, 1999). The cognitive abilities of environment-based students should be enhanced through the application of ecological science on lecture materials, in order to support the readiness to behave in the face of various issues and environmental problems that

are increasing in number. Environmental problems occurring in local, regional, and global cases can be addressed by ecological sciences that contribute substantially in understanding and overcoming environmental problems (Lewinsohn, Attayde, Fonseca, Ganade, & Jorge, 2015). Ecological science is used to facilitate decisions on various actions taken in relation to environmental issues (Kiker, T.S. Bridges, Varghese, & Seager, 2005). The literature on ecological literacy today emphasizes the role of scientific knowledge and ecological thought to enable better decision making (McBride, Brewer, Berkowitz, & Borrie, 2013). Ecological literacy is intended to increase one's awareness and participation in making the right decisions or taking action of environmental problems (Jordan, Singer, Vaughan, & Berkowitz, 2009). Another opinion about ecological literacy is that it can serve as a space for communication and has a strong influence on the outcome of the discussion in a consensus in taking decisions (Duailibi, 2006).

Some ecologists who are competent in their field have considered the content and framework of pedagogy that must be presented in ecological literacy. But ecological science cannot be applied to everyone, the ecological literacy framework should take into consideration on the list of knowledge and special skills that a person possesses so that it can be practically applied according to current circumstances (McBride et al., 2013). The content of ecological literacy that can assist a person in making decisions must include several aspects such as knowledge, concern, and attitude (AL-Dajeh, 2012). Mansaray et al. Revealed to Al-Dajeh (2012) that the ecological literacy component is crucial to deal with global and local environmental problems. Duailibi (2006) states that ecological literacy can be applied, one of them, through continuous education so it can teach ecology deeply. Education for a sustainable life is to increase understanding of how ecosystems sustain life so that humans acquire the knowledge and commitment necessary to design sustainable human communities.

Sebelas Maret University is one of the universities that provide education in Indonesia. Sebelas Maret University supports education programs for sustainable living in the campus area through the Green Campus program. Sebelas Maret University has provided ecology to students in several study programs in Biology Education Program, Geography Study Program, and Biology Study Program. The measurement of ecological literacy capability was performed on the students of Sebelas Maret University using a validated ecological literacy questionnaire. The ecological literacy component used refers to Al-Dajeh (2012) which includes knowledge, concern, and attitude. The results obtained indicate the low level of knowledge and attitudes possessed by students. The average value of the students' knowledge aspects of the three majors is <50% so that it is still below the sufficient value. Furthermore, the average value attitude aspect is still low, additionally, the attitude instrument using a Likert scale so that the existing data is the interval data. The purpose of this study is to determine the relationship and influence between cognitive abilities and attitudes as well as the relationship between these two aspects of behavior that is formed on the students. Yet, some reasons may be given as a basis for the low level of knowledge and attitudes on the students.

Ecological literacy, in fact, emphasizes more on the aspect of one's knowledge needed to make the right decisions. Students with a high ecological concept are able to understand the environmental reality and identify the cause of environmental problems (McBride et al., 2013). Knowledge owned by students greatly affects the attitude that is formed. Torkar et al. (2010) state that a person's high attitude is influenced by the knowledge he has. Some research has revealed that knowledge can affect one's behavior. In addition to affecting one's attitude, the knowledge aspect also influences one's own behavior (Ajzen, 2001). Fisher & Fisher (1992) (in Ajzen 2001) reveals that although knowledge can shape behavior but the knowledge aspect is insufficient to produce the desired behavior. The influence of the knowledge aspect of behavior is relatively small and inconsistent. Aspects of knowledge can influence both directly and indirectly through a combination of one's knowledge and motivation (Fisher J. D., Fisher, Williams, & Malloy, 1994). The knowledge mentioned is knowledge based on the environment. However, the influence of knowledge is not as great as the effect of attitudes toward the formation of one's behavior (Maloney, Ward., & Braucht, 1975). A person's behavior is also influenced by the attitude he has. Kaiser et al. (1999) state that attitudes possessed can affect behavior that appears to someone. The influence of attitudes toward behavior are defined as a person's positive or negative feelings about performing behaviors. This is determined through an assessment of one 's beliefs about the consequences arising from behavior and as a material evaluation of the consequences (Fishbein & Ajzen, 1974).

METHOD

This study aims to determine the influence and relationship between the aspects of knowledge and the aspects of attitude as well as to determine the influence between these two aspects of behavior formed on the students. The research was conducted by using ecological literacy instrument as a valid and reliable instrument to measure students' ecology ability. Components in ecological literacy include knowledge, concern, and attitude. Instruments used to measure aspects of knowledge are prepared based on an existing rubric.

Knowledge Instrument

The instrument rubric on the knowledge aspect is structured which referred to the ecological concept according to Lewinsohn (2015). The concept of ecology has 10 components including ecosystem resilience, productivity, nutrient cycling, functional redundancy, trophic cascade, habitat fragmentation, community assembly, dispersal, population control, ecophysiological adaptation, and one additional component; anti-anthropocentrism. The structure is adjusted to knowledge and cognitive dimensions according to Taxonomy Bloom which has been revised by Anderson (2014). This knowledge aspect is then connected with the NEP (New Ecological Paradigm) component. The NEP component is structured to measure factors affecting human attitudes and behaviors from various environmental issues. The preparation of the knowledge aspect instrument is in the form of multiple choice test with 33 question items. The total score of the knowledge result is calculated by the number of correct answers without reference

to the reasons used to support the selected answer. **Fig. 1** below presents information on the preparation of the knowledge aspect instrument.

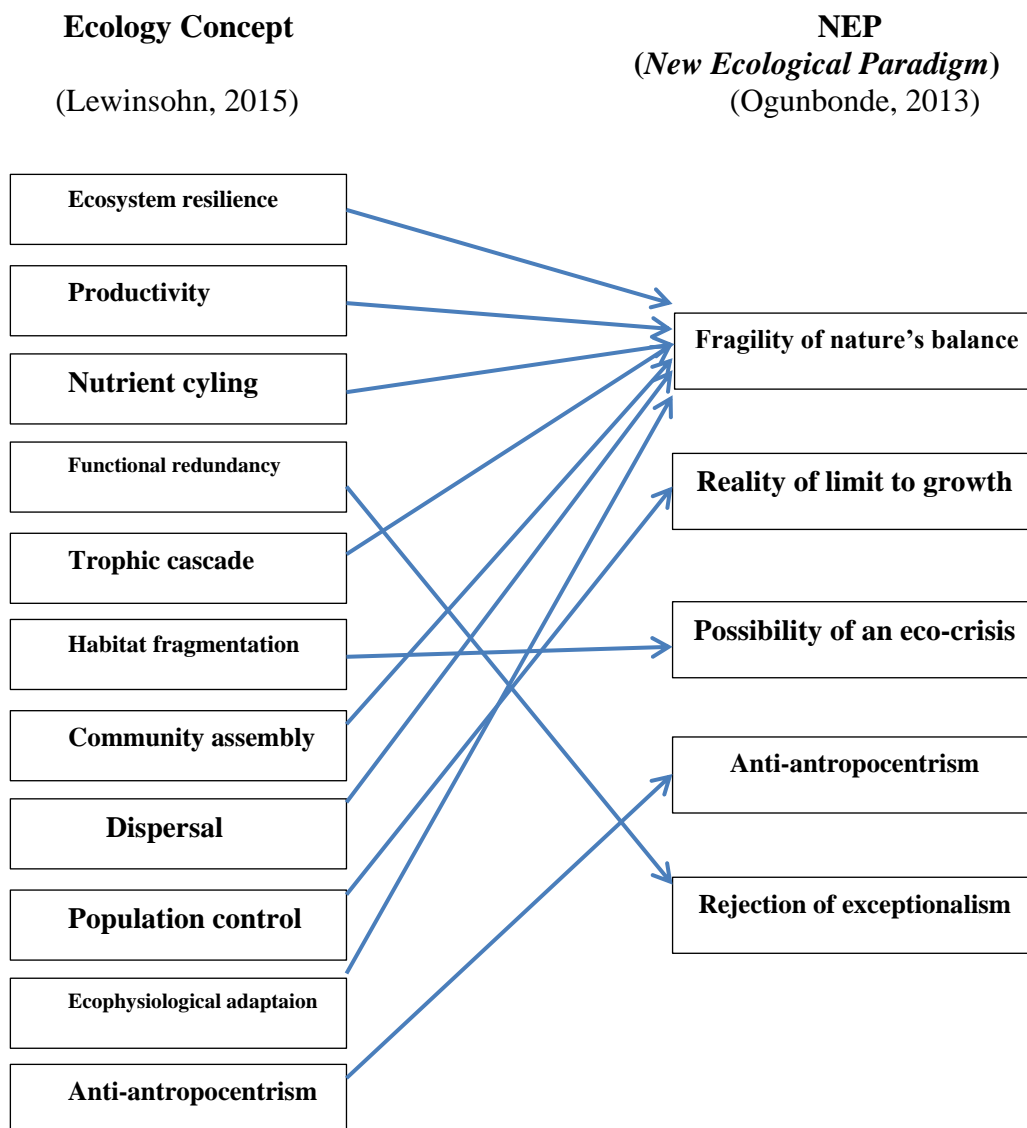


Fig. 1: The relationship of ecological concepts with the NEP aspect to measure student knowledge. The preparation of the ecological literacy instrument on the aspects of knowledge should consider knowledge and cognitive dimensions according to Bloom's taxonomy according to Anderson.

Attitude Instrument

An instrument for attitude aspect uses NEP (New Ecological Paradigm) instrument that has been validated and has been applied in several countries (Ogunbode, 2013). The NEP instrument is used to measure factors affecting eco-friendly behavior. It focuses on beliefs about the human ability to disrupt the environment and to limit the growth and development of the human economy, and human rights to dominate natural resources. The NEP has five components that

include the fragility of nature's balance, the reality of limits to growth, the possibility of an eco-crisis, anti-anthropocentrism, rejection of exceptionalism (Ogunbonde, 2013; Dunlap, 1978). The NEP instrument has undergone various revisions since it was first published in 1978. Currently, the NEP instrument has been refined and developed into fifteen statements with 5 points of Likert scale (Kopnina, 2011; Dunlap R. E., 2000; Hawcroft & Milfont, 2010).

Sampling was done by using Proportionate stratified random sampling technique toward the students at Sebelas Maret University. Only a few students in a particular major are used for data retrieval. The majors are Biology Education, Geography Education, and Biology. The reason for taking them is based on giving the ecology concept to the course received in the lecture. Measurement of ecological literacy capability will be better implemented on objects who have or are learning about ecology. Students of Biology Education of 2014 who were taking ecology courses in semester 6 with 46 students were selected as respondents, but only 39 students who participated. Students of Geography Education used as respondents were a student of 2015 who has taken ecology subject in semester 2 containing 59 students but only 57 participated in filling instrument. 57 Biology students of 2015 taking ecology courses in semester 4 were used as respondents, but only 53 students who participated. In the other word, the ecological literacy instrument was disseminated to 149 students from all three courses at Sebelas Maret University. Following the instrument, data retrieval using interview technique and document observation learning device were conducted to support the result of ecological literacy instrument data. The student profiles used for the respondents are listed in Table 1 below.

Table 1. Respondents' profiles of three majors in Sebelas Maret University

Respondents	Biology education		Geography education		Biology	
	Frequency	Percent (%)	Frequency	Percent (%)	Frequency	Percent (%)
<i>Gender</i>						
Male	4	10,2	18	30,5	11	19,2
Female	35	89,7	39	66,1	42	73,6
Total	39	99,9	57	96,6	53	92,8
Missing	0	0	2	3,4	4	7,2

The questioner response to the filling of the ecological literacy instrument was then analyzed using SPSS 2.0. Quantitative analysis by correlation and regression was used to find the relationship between knowledge and attitude aspects. And the relationship and influence of knowledge and attitude toward student behavior. The value of the correlation and the regression depends on the lecturing activities, the ecology material given to the students, and the lecture set by lecturers independently or in groups.

RESULT AND DISCUSSION

The results of the measurement using the ecological literacy questionnaire are then analyzed quantitatively by correlation analysis and regression analysis to find the relationship between the knowledge and attitude aspects and to find the relationship between the knowledge and attitude toward the students' of Sebelas

Maret University behavior. The following table presents the results of correlation and regression analysis using SPSS 2.0 in all three majors at Sebelas Maret University.

Biology Education Major

Prior to analysis of correlation and regression analysis, there should be normality test and homogeneity test. The knowledge aspect has normal distribution data with a significance value of 0.2 greater than 0.05 and has homogeneous data with a significance value of 0.979 greater than 0.05. While data on the attitude aspect show normally distributed data with a significance value of 0.07 greater than 0.05 and has a homogeneous data with a significance value of 0.064 greater than 0.05. The results of the correlation test and regression test can be seen in Table 2 and Table 3.

Table 2. The correlation between knowledge and attitude aspect

Correlations			
		knowledge	attitude
knowledge	Pearson Correlation	1	,158
	Sig. (2-tailed)		,257
	N	53	53
attitude	Pearson Correlation	,158	1
	Sig. (2-tailed)	,257	
	N	53	53

Table 3. The regression of knowledge and attitude aspect of behavior

REGRESSION						
Model	Sum of Squares	df	Mean Square	F	Sig.	
1	Regression	45,520	1	45,520	1,312	,257^b
	Residual	1769,357	51	34,693		
	Total	1814,876	52			

- a. Dependent Variable: attitude
- b. Predictors: (Constant), knowledge

It can be inferred from Table 2 that correlation value between the aspects of knowledge and attitude aspects showed a significance value of 0.257 while the Pearson correlation value of 0.158. The correlation between aspects of knowledge and attitude aspects shows the value of 0.158. This shows the relationship between aspects of knowledge and attitude. Therefore, the higher the aspect of students' knowledge is, the higher the attitude aspect of the students is.

The presence of influence for eco-friendly behavior implied by knowledge instrument responses found a significant correlation with attitudes, thus regression analysis was performed to support the relationship between the two aspects. As shown in Table 3, regression value of 0.257 indicates that there is a relationship that can improve the eco-friendly behavior because of the effects of knowledge and attitude aspects.

The result of the research conducted on students of Biology Education shows acceptance of correlation values and regression values based on calculations using SPSS 2.0 application. There is a relationship between aspects of knowledge and attitude aspects which is shown with significance value > 0.05. Some reasons

supporting the results of the study was obtained from interviews with lecturers and students as well as observation of document learning tools. Supporting data from learning activity aspect and learning model used in teaching learning process is acquired during the interview with lectures. The method used by lecturers for classroom learning activities in ecology courses is done by presenting environmental topics or issues that are being discussed in the mass media. As expressed by Pickett et al. (2007) that the understanding of ecology can be done by combining between the two components of concept building and observation of problems or environmental issues. Environmental issues are then used as a discussion material by students to be studied more deeply so that students' knowledge related to environmental issues becomes better. Hence, when students study environmental issues, they are indeed building concepts related to the issues. While studying environmental issues, students should be able to provide alternative solutions that can be used to address these issues and can be applied practically in life. However, the results of interviews conducted on some students reported that lectures are still often focused on lecturers; lecturers often convey material with lecturing methods and not often present environmental issues as a discussion. Herein, there is a gap between the opinions expressed by lecturers and those by students. The ecological concept taught through ecological subjects has covered the concept of the ecology of Lewinsohn (2015) that has been distributed entirely to all lecture materials provided. Document observation of instructional devices used by lecturers shows that the ecological concept has been distributed into all lecture materials. Table 4 below shows the distribution of ecological concepts in lecture materials.

Table 4. The distribution of ecological concepts in lecture materials.

Study Materials	Ecology Concepts
Basic animal ecology	Anti-anthropocentrism
Distribution and abundance	Dispersal, community assembly
Land biography and habitat fragmentation	Habitat fragmentation
Native species and habitat selection	Community assembly
Concept, character, and interaction in population	Dispersal, community assembly
Animal population and population census method	Population control
Concepts in community	Community assembly
Interaction in community	Productivity, nutrient cycling, trophic cascade
Energy concept in community	Productivity, nutrient cycling, trophic cascade
Adaptation concept	Ecophysiologic adaptation
Animal concervation	Functional redundacy, anti-anthropocentrism

The distribution of ecological concepts on lecture materials can improve students' knowledge of ecology. Ecological science is a prerequisite for improving eco-friendly behavior. Several studies have produced that there has been a relationship between one's knowledge and their behavior (Maloney, Ward., & Braucht, 1975).

One's eco-friendly behavior can also be influenced by their attitudes (Weigel, 1974; Lynne & Rola, 1988). Therefore, the result of the regression value showing the relationship and the influence between the knowledge aspect and the student's attitude toward the formation of eco-friendly behavior can be accepted with some of the reasons described above.

Geography Education Major

Normality test and homogeneity test become pre-test before conducting correlation test and regression test. The knowledge aspect has normal distribution data with a significance value of 0.054 greater than 0.05 and has a homogeneous data with a significance value of 0.984 greater than 0.05. While the data on the attitude aspect presents normally distributed data with a significance value of 0.001 smaller than 0.05 and has a homogeneous data with a significance value of 0.999 greater than 0.05. Although the homogeneity of the attitude aspect is more than 0.05, the correlation test and regression test will still be conducted. The value of correlation test and regression test can be seen in Table 5 and Table 6.

Table 5. The correlation between knowledge and attitude aspects

Correlations			
		attitude	knowledge
attitude	Pearson Correlation	1	-,006
	Sig. (2-tailed)		,965
	N	57	57
knowledge	Pearson Correlation	-,006	1
	Sig. (2-tailed)	,965	
	N	57	57

Table 6. The regression of knowledge and attitude aspects toward behavior

REGRESSION						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	,185	1	,185	,002	,965^b
	Residual	5169,842	55	93,997		
	Total	5170,027	56			
a. Dependent Variable: attitude						
b. Predictors: (Constant), knowledge						

Table 5 shows the correlation between knowledge and attitude aspects with a significance value of 0.965 while Pearson correlation value is -0.006. The correlation between aspects of knowledge and attitude aspects shows -0.006. This shows no relationship between aspects of knowledge and attitude aspects. The relationship between aspects of knowledge and attitude aspects is very low. Figures (-) show a weak correlation between aspects of knowledge and attitude aspects.

The lack of influence for eco-friendly behaviors implied by the knowledge instrument response was not significantly correlated with the significant score, the regression analysis was used to see the support of the relationship between the two aspects toward student behavior. As shown in Table 6, the regression significance value of 0.965 indicates that there are strong relationships and influences to improve eco-friendly behavior due to the effects of knowledge and attitude aspects.

The results of research conducted on Geography Education students get a weak correlation value and high regression value. Correlation value indicates the weak relation between knowledge and attitude of the student. This is because the ecological concepts given to the lecture materials are not all well distributed. There are several components of ecological concepts that are not given to students in ecological subjects. Ecological concepts not given to lectures include nutrient cycling, habitat fragmentation, control population, and anti anthropocentrism. This leads to a weak relationship between knowledge and student attitudes. Table 7 below shows the distribution of ecological concepts in lecture materials.

Table 7. The distribution of ecological concepts in lecture materials

Study Materials	Ecology Concepts
Ecosystem and Environment	Ecosystem resilience, dispersal, productivity, trophic cascade, community assembly
Environment Phenomenon	Functional redundancy, ecophysiological adaptation, ecosystem resilience
Ecosystem Mapping	Community assembly, dispersal, trophic cascade

The result of a correlation analysis showing no relationship between knowledge and attitude despite the fact that knowledge is closely related to one's attitude (Ajzen, Joyce, Sheikh, & Cote, 2011). The result of this correlation test is not in line with the interview of ecology subject lecturer. The lecture method is given based on the topic of International Global Heart which addresses conservation and ecology issues. Giving these topics should increase students' interest in ecology to empower the culture of environmental conservation. Lecturers have also provided field lectures that students can apply ecology knowledge directly. However, it does not have a big effect if the students still tend to be passive and have low learning motivation. Because the provision of knowledge will affect the attitude better when combined with aspects of motivation and other aspects (Fisher J. D., Fisher, Williams, & Malloy, 1994).

Regression result showed a positive result with significance value $> 0,05$ which means that there are relationship and influence between knowledge and attitude toward eco-friendly behavior which is formed although there is no correlation between knowledge and attitude. According to Kaiser et al. (1999), the behavior is influenced by several components one of which is the factual knowledge and attitude.

Biology Major

Pre-test before the correlation test and regression test must pass normality and homogeneity test first. The knowledge aspect has normal distribution data with a 0.074 significance value greater than 0.05 and has a homogeneous data with a significance value of 0.078 greater than 0.05. While the data on the attitude aspect present normally distributed data with a significance value of 0.2 which is greater than 0.05 and has a homogeneous data with a significance value of 0.658 greater than 0.05. The value of correlation test and regression test can be seen in Table 8 and Table 9 below.

Table 8. The correlation between knowledge and attitude aspect

Correlations			
		attitude	knowledge
attitude	Pearson Correlation	1	-,087
	Sig. (2-tailed)		,534
	N	53	53
knowledge	Pearson Correlation	-,087	1
	Sig. (2-tailed)	,534	
	N	53	53

Table 9. The regression of knowledge and attitude aspect of behavior

REGRESSION						
	Model	Sum of Squares	df	Mean Square	F	Sig.
1	Regression	12,414	1	12,414	,391	,534 ^b
	Residual	1617,775	51	31,721		
	Total	1630,189	52			

a. Dependent Variable: attitude

b. Predictors: (Constant), knowledge

Table 8 shows the correlation between the knowledge and attitude aspects with the significance value of 0.534 while the Pearson correlation value is -0.087. The correlation between aspects of knowledge and attitude aspects shows -0.087. This shows that there is no correlation between knowledge aspect and attitude aspect to the student. The relationship between aspects of knowledge and attitude aspects is very low. Figures (-) show a weak correlation between aspects of knowledge and attitude aspects.

The lack of influence for eco-friendly behaviors implied by the knowledge instrument response was not significantly correlated with the significant score, the regression analysis was used to see the support of the relationship between the two aspects of student behavior. As shown in Table 9, regression significance value of 0.534 indicates that there are a strong relationship and influence to improve the eco-friendly behavior because of the effects of knowledge and attitude aspects.

The results of the research on the students of Biology Studies Program show correlation value that shows the sign (-) which means there is no relationship or it has a very weak relationship between knowledge and attitude. Observation on learning tool document cannot be done because there is no learning device applicable for ecology subject in the biology major. This causes the ecological concept given to students to be unconstructed and unstructured. Although students get more ecological material than those given to students in Biology Education and Geography Education but it would be better if it is more conceptualized by the formation of learning tools such as RPS (Semester Learning Plan). The results of interviews with lecturers and students indicate that the lectures given have been able to facilitate the students in improving their ecological knowledge but there are some constraints on the liveliness of students in responding to the topic given by lecturers. Student's motivation is still low. This will affect the quality of knowledge.

Regression results show the influence of knowledge and attitude toward eco-friendly behavior. This is seen from the regression value of 0.543. Although the

correlation value is marked (-) there is a relationship between knowledge and attitudes toward eco-friendly behavior on the students of the biology major.

CONCLUSION

The research to measure the relationship and influence of knowledge and attitude aspects using ecological literacy instrument applied to Biology Education, Geography Education, and Biology at Sebelas Maret University acquire the result which has been analyzed quantitatively to find the correlation and regression. The result of correlation value of the three majors that has relationship is only at Biology Education with correlation value is $0,158 > 0,05$, whereas in Geography Education obtain correlation value $-0,006 < 0,05$, for Biology, the correlation value is $-0,087 < 0,05$. While for the regression value for the three study programs get the same result that is $> 0,05$ which means there are a relationship and the influence of knowledge and attitudes that students have on eco-friendly behavior formed. The results of this study are consistent with the argument from several studies that have been done before that there is the influence of knowledge and attitudes toward eco-friendly behavior.

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